SOCIETIES AND ACADEMIES.

LONDON.

Royal Society.—"A New Form of Self-restoring Coherer." By Sir Oliver **Lodge,** F.R.S. Communicated verbally March 12, received in manuscript March 18.

The essential part of the receiving instrument now always employed in the system of Hertzian telegraphy, which Dr. Muirhead and the author had brought out and always now employed, and which their assistant, Mr. E. E. Robinson, had helped to work out, might be described as a development of the mercury form of coherer described some years ago by Lord Rayleigh, and again in a modified fashion by Mr. Rollo Appleyard. In Lord Rayleigh's form this consisted of a pool of mercury cut across with a paraffined knife, and the two half pools connected to a battery and key. As soon as the key was depressed so as to throw a few volts on to the intervening film of oil, the electrostatic pressure seemed to squeeze the oil out, and the pools of mercury became one. The pressure exerted by a few volts on a film of barely soap-bubble thickness is very considerable, and comparable to a ton per square inch.

Needle points dipping in oil and mercury were tried as practical coherers, the points being pulled out electromagnetically every time a signal arrived. Rotating forms of contact for automatic decoherence were also tried in various forms, and ultimately the method took the form of a rotating sharp-edged steel wheel, about half an inch in diameter, constantly touching a pool or column of mercury on which was a thin layer of oil. No effective contact occurs between the wheel and the mercury, notwithstanding the immersion, because of the film of oil; but the slightest difference of potential applied to the two, even less than one volt, is sufficient to break the film down and complete a circuit, which, however, the rotation of the wheel instantaneously breaks again. A spark is so sudden that for its purposes the wheel is for the instant virtually stationary, and yet the decohesion is so rapid that signals can be received in very rapid succession. The definiteness of the surfaces and of the intervening layer make the instrument remarkably trustworthy, and the thinness of the insulating film makes it very sensitive. In fact a single cell of a battery cannot be employed as a detector, because it is of too high a voltage for the film to stand. A fraction of a volt is employed, by a potentiometer device—usually something like one-tenth of a volt—and it is adjusted to suit circumstances. The battery acts through the coherer direct on a low resistance recorder, and the record on the strip shows every character of the arriving pulses, and exhibits any defect in the signalling. Provided that every joint and contact, except the one intended to be filmed, is thoroughly good, the coherer in this form is so definite and satisfactory that it becomes safe to say that the only outstanding defects are those which occur at the sending end. The signals are picked up and recorded precisely as they are emitted, as has been tested by intercalating a siphon recorder in a much diluted tapping circuit at the sending end, so as to get a record with which to make comparison. The traces obtained at the two ends are identical to a surprising degree.

The mercury level has an adjustment which is easily made. One precaution is to keep the rim of the wheel clear of dust, which is done by a cork or leather pad pressed lightly against it by a spring.

The instrument is not at all sensitive to tremor, and requires no particular delicacy of adjustment. The wheel has to be positive, the mercury negative.

A telephone in circuit, through a transformer or otherwise, affords an easy method of occasionally discriminating the signals by ear. The speed of the wheel gives another convenient adjustment to suit various circumstances.

A simple laboratory form of the instrument, driven by a thread from Morse clockwork, can be placed in circuit with a simple form of potentiometer and a siphon recorder, and used for Hertz-wave investigation purposes. It is connected with the collecting areas through a transformer, the coils of the recorder being in that case shunted by means of a condenser, so as to allow the full effect of the impulse to be felt at the film without having to overcome anything of the nature of a choke coil or other obstruction, in cases where sensitiveness is desirable.

Royal Astronomical Society, April 8.—Prof. H. H. Turner, president, in the chair.—Prof. **Sampson** gave an account of the Almucantar erected under his supervision at the Durham Observatory, and described the instrumental errors, and methods of adjustment of the instrument, and the observations made with it during 1902.—The **Astronomer Royal** exhibited photographs of the recent sunspots, and curves showing the terrestrial magnetic disturbances which had accompanied the outbreak of solar activity. In the course of the discussion Prof. Turner showed a photograph of solar faculæ, &c., taken by Prof. G. E. Hale with the spectroheliograph at the Yerkes Observatory.—Mr. F. A. **Bellamy** read a paper on the new star in Gemini found by Prof. Turner from an examination of astrographic plates taken at the Oxford University Observatory. There was no trace of the star on plates taken February 21 and 28, but on March 16 it appeared as of the seventh magnitude. Prof. Pickering had since examined the plates taken at Harvard Observatory, and found an image of the star on a photograph of March 6, though there was no trace of it on earlier plates. On March 6 the Nova was of the fifth magnitude: it had therefore considerably diminished in brightness when found at Oxford, and appeared to be still slowly becoming fainter. The spectrum showed many bright lines.—Father **Goetz** gave an account of observations proposed to be made at a new observatory to be established in Bulawayo, Rhodesia, and of which he was about to take charge.—Prof. Michie **Smith** described the new observatory at Kodaikánal, in southern India, illustrated by photographs of the observatory and its surroundings, and gave a brief account of the observations being made there.

Entomological Society, April 1.—Prof. E. B. Poulton, F.R.S., president, in the chair.—Mr. M. **Jacoby** exhibited specimens of *Rhagiosoma madagascariensis,* Heyd., from Madagascar, and *Carpophagus Banksiae*, McLeay, and *Mecynodera coxalgica*, Boisd., from Australia. In appearance they presented many characteristics not usually associated with Phytophagous Coleoptera.—Mr. C. P. **Pickett** exhibited specimens of *Dilina tiliae* bred from Essex pupæ, showing the effects of forcing.—Mr. W. J. **Lucas** exhibited lantern slides of the specimen of *Hemianax ephippiger*, and of the Orthetrum species attacked by an Asilid fly, shown by Mr. R. McLachlan at the last meeting.—Dr. T. A. **Chapman** read contributions to the life-history of *Orina* (*Chrysochloa*) *tristis*, var. *smaragdina*.—Mr. F. **Enock** read a paper, illustrated with lantern slides, on the life-history of *Cicindela campestris*.—Sir George **Hampson** read a paper on *Apoprogonia hesperioides*, a remarkable new lepidopterous insect from Zululand. He said that the genus must be referred to the Euschemonidæ, which is represented by the single species *Euschemon rafflesiae*, Westw., from Australia. In what quarter of the globe the family originated it was impossible to say, but the appearance of the species in question suggested that it was a survival of the scattered remnant of the Antarctic fauna. It was, however, most remarkable that the genus should occur in Africa and Australia alone.

Royal Meteorological Society, April 15.—Captain D. Wilson-Barker, president, in the chair.—Mr. F. J. **Brodie** read a paper on the prevalence of gales on the coasts of the British Islands during the thirty years 1871–1900, being a continuation of a paper on the same subject which he communicated to the Society last year. The total number of gales dealt with during this period was 1455, the yearly average being 48·5, of which 10·6 were severe. The present paper deals with (1) the number of gales experienced on the west, north, south, and east coasts respectively, (2) the prevalence of gales at different times in the year, and (3) the mean direction from which gales blow on various parts of our coasts.—A paper on the duration of rainfall, by Mr. J. **Baxendell,** was read by the secretary. In this paper the author refers to various patterns of self-recording rain-gauges, and points out the defects inherent to them, and also states that it is hardly possible to determine from them the rate at which rain falls, especially in very small quantities. From a Halliwell's self-recording rain-gauge which had been in operation at Southport during 1902, the total duration of rainfall for the year was 640·1 hours. The author showed that the hourly duration values give a

striking curve of diurnal variation, the early morning maximum being most pronounced; the afternoon one is also present, but is much less protracted and of far less amplitude than the former. Minima occur about mid-day and in the evening. The author concluded by giving an account of Halliwell's float pattern self-recording rain-gauge.

Mathematical Society, April 16.—Dr. E. W. Hobson, vice-president, in the chair.—Mr. C. S. **Jackson** exhibited the logo-logarithmic slide-rule constructed from a design prepared by Colonel Dunlop and himself, and gave an account of the history of the invention. In principle it goes back to the early part of the nineteenth century.—The following papers were communicated:—Prof. A. **Lodge,** Relations between points (in a plane) having conjugate complex coordinates. This is an addition to a paper read at the meeting in January, 1903.—Prof. A. E. H. **Love,** Note on exact solutions of the problem of the bending of an elastic plate under pressure. The method given by Michell in *Proceedings*, vol. xxxi., yields exact solutions of the problem, which can be determined completely when the plate is bent by uniform pressure applied to one face, or by pressure varying uniformly over the face, and the (clamped) edges are circular or elliptic. For any form of clamped edge the deflexions produced by such pressures are determined by the same differential equations and boundary conditions as arise in the ordinary approximative theory. The principles on which the ordinary theory is founded are true to a certain order of approximation only. The small corrections which must be made do not affect much the calculation of the strength of the plate to resist bending, but they account rationally for the existence of the shearing stresses and of the tension (analogous to that of a membrane) by which the pressure is balanced. Under uniform pressure the median plane of the plate is unstrained, but under varying pressure this surface undergoes a small extension.—Mr. E. T. **Whittaker,** On those functions which are defined by definite integrals with not more than two singularities. Among the functions included in this class are the Bessel functions, the error-function, the logarithm-integral, the cosine-integral. A definite integral containing two numerical parameters is discussed, and it is shown how, by specialisation of the parameters, the above-mentioned functions and many others can be obtained. The functions defined by the definite integral satisfy a linear differential equation of the second order which is a generalisation of Bessel's equation; they possess asymptotic expansions, and are connected by recurrence-formulæ and integral-formulæ analogous to those which hold in the case of Bessel functions. Attention is drawn to new functions included in the class defined by the general definite integral.—Mr. H. **MacColl,** On the validity of certain formulæ. The paper contains a criticism of certain formulæ in the algebra of logic.—Mr. A. **Young,** On covariant types.—Mr. R. F. **Gwyther,** On the deduction of Schlömilch's series from a Fourier series, and its development into a definite integral. The paper presents a demonstration of the connection of Schlömilch's expansion of an arbitrary function in a series of Bessel functions of order zero with Fourier's expansion of the same function in terms of cosines. Both expansions can be represented by the same surface integral, and the one is transformed into the other by change of the variables in the double integral.—Messrs. H. W. **Richmond** and T. **Stuart,** The inflexion-conic of a trinodal quartic curve. It is known that the six points of inflexion of a trinodal quartic curve lie on a conic. The paper contains two simple proofs of this theorem, and the equation of the conic is obtained explicitly in various systems of coordinates.

EDINBURGH.

Royal Society, February 16.—Lord M'Laren in the chair.—Dr. J. **Beard** communicated a paper on the embryology of tumours, in which, after a critical examination of the theories which had been brought forward, he gave a detailed description of his own views. The continuity of germ cells from generation to generation was now becoming generally accepted among embryologists. The fertilised egg did not, however, give rise directly to an embryo, but rather to a set of germ cells, every one of which had the power, with appropriate environment, of developing into an embryo. The number of germ cells in a particular species was always some power of two; for example, eight in the frog, thirty-two in the lamprey, 128 in the dog-fish, &c. Of these one went to form the embryo, and the remainder migrated or wandered about in the embryonic body to furnish the foundation of the reproductive products. A certain percentage would get hopelessly wandered, and never find their way to the normal position. It was in these aberrant or "lost" germ cells that Dr. Beard found the origin of tumours. In short, a tumour was a more or less reduced, more or less incompletely differentiated sterile Metazoan organism. It started by the abnormal development of a vagrant germ cell, and growing under conditions unfavourable to the complete and normal differentiation of all its parts, it unfolded and developed those things for the growth of which the nidus was suitable, the rest degenerating. Exactly as identical twins were the offspring of two sister or brother germ cells identical in ancestry from the same primitive germ cell, so any animal and a tumour within it stood in the same relation of ancestry from one primitive germ cell.—Sir John **Murray** communicated some preliminary observations on seiches in certain Scottish lochs, and exhibited a seichometer with which he hoped in the coming season to get a more definite and precise record of these oscillations.—Prof. **Chrystal** then gave an account of the theory of seiches, touching on the work that had been done by the Swiss and American investigators, and developing the mathematical theory in a form convenient for application. The theory was illustrated by a series of experiments in a rectangular trough, carried out with great skill by Mr. E. Maclagan Wedderburn, the characters of the uninodal and binodal seiches and the influence of a shelving bottom being well brought out.—A short paper was presented by Prof. **Anglin** on the equation of a pair of tangents to a conic.

DUBLIN.

Royal Dublin Society, March 17.—Mr. Samuel Geo ghegan in the chair.—On the petrological examination of paving sets, by Prof. J. **Joly,** F.R.S. By examination of the worn surfaces of many different sorts of paving sets, in conjunction with petrological examination of the rock, it is found possible to connect the qualities of the set with the nature and relative amounts of the mineral constituents present in the rock. The petrological examination of the rock now becomes a very sure guide in the examination of an untried set; its degree of durability and roughness under wear can be foretold with a high degree of certainty.—Mr. William **Tatlow** exhibited and described an aluminium rectifier for alternating electric currents, and a three-phase rotary converter.

PARIS.

Academy of Sciences, April 14.—M. Albert Gaudry in the chair.—On certain algebraic surfaces for which the integrals of the total differentials reduce to algebraical logarithmic combinations, by M. Emile **Picard.**—On the discussion and integration of differential equations of the second order with constant coefficients, by M. E. **Vallier.**—The catalytic decomposition of alcohols by finely divided metals; primary alcohols, by MM. Paul **Sabatier** and J. B. **Senderens.** The reactions previously described for ethyl alcohol have been extended to higher alcohols of the same class, and it has been found that, with reduced copper between certain limits of temperature, the alcohol is split up into the corresponding aldehyde and hydrogen, without any secondary reactions of importance. With reduced nickel the reaction is more violent, the aldehyde formed being further acted upon.—The sounds emitted by sand in motion, by M. **Lortet.**—On the projection of matter round the electric spark, by M. Jules **Semenov.** From the experiments described it would appear that gases and vapours, traversed by a spark, are thrown out by it in all directions, as a consequence of the sudden elevation of temperature. The direction of the current does not appear to have any effect upon the sense of this projection.—The action of radio-active bodies on the electric conductivity of selenium, by M. Edmund von **Aubel.** The radio-active bodies examined acted upon selenium in a manner resembling light or the Röntgen rays, but the effect is produced much more slowly.—On the electric and magnetic dichroïsm of liquids, by

M. Georges **Meslin.**—An experimental contribution to the physiology of death, by MM. N. **Vaschide** and Cl. **Vurpas.**—On the principal alimentary Leguminosæ of the French colonies, by M. **Balland.**

ST. LOUIS.

Academy of Science, April 6.—Prof. F. E. Nipher reported that he had apparently succeeded in producing a distortion of a magnetic field by means of explosions. The apparatus used was a transformer consisting of concentric coils wound upon brass tubes. The outer tube was five inches in diameter and six feet long, wound with more than four thousand windings of No. 16 wire. This coil was traversed by a continuous current from a storage battery. Within this, and separated from it by an air-space of an inch, is a secondary coil of equal length, having more than twenty-five thousand windings of No. 25 wire. This coil is connected to a D'Arsonval galvanometer. Within the tube on which this coil is wound is a smaller brass tube within which a train of black gunpowder is laid. This tube is open at both ends, and has practically no recoil when the explosion is made. When hung by a bifilar suspension on cords ten feet in length, the recoil is about an inch. When the exciting current is small compared with the capacity of the battery, the galvanometer reading is very steady. When the train is exploded, a sudden and marked throw of the galvanometer results, which could be accounted for by an increase in the permeability of the long explosion chamber. The deflection reverses when the field is reversed. The hot gases liberated in the explosion are all diamagnetic, and tend to decrease the observed effect. In two cases the galvanometer deflection was in the opposite direction from that stated above, and this is being further inquired into. When seven tubes between the two coils are simultaneously exploded, only slight effects can be obtained, and these deflections are wavering, or to and fro, in character. A wire was threaded through the inner combustion tube, through which a current of three amperes was passed. This circuit was opened and closed with no visible effect. The galvanometer circuit is shielded by tin-foil, which is also connected with the explosion tube, and grounded. Sparks an inch long to the tin-foil produce no result. When the explosion tube is removed from the transformer, and taken near the galvanometer or the storage battery, no deflection is produced by the explosion. An explosive mixture of gases from water electrolysis under atmospheric pressure produces a much less violent explosion, and produces a correspondingly less effect. The scale reading of the galvanometer changes by more than twenty divisions with the heaviest explosions, and an exciting current of 0·6 ampere. With smaller explosions or feebler currents, the effect is diminished. No deflections can be produced by striking the table upon which the transformer rests, nor by striking the transformer itself, even when it moves slightly under the blow. The secondary and primary coils are held rigidly in fixed position with respect to each other. Arrangements have now been made to place the explosion tube in the focal line of a parabolic cylinder of metal, the galvanometer coil being in the focal line of a similar mirror. Either or both are to be surrounded by an exciting coil. This line of research was suggested by Young's account of his observation of five solar outbursts in 1872, which were each accompanied by sharp fluctuations in the magnetic tracings at Kew and Stonyhurst.

DIARY OF SOCIETIES.

THURSDAY, APRIL 23.

ROYAL INSTITUTION, at 5.—Hydrogen: Gaseous, Liquid and Solid: Prof. Dewar, F.R.S.

SOCIETY OF ARTS, at 4.30.—The Province of Sind: Dr. Herbert M. Birdwood.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Distribution Losses in Electric Supply Systems: A. D. Constable and E. Fawssett.—A Study of the Phenomenon of Resonance in Electric Circuits by the Aid of Oscillograms: M B Field. *And, if time permit.*—Divided Multiple Switchboards: An Efficient Telephone System for the World's Capitals: W. Aitken.

FRIDAY, APRIL 24.

ROYAL INSTITUTION, at 9. Some Recent Investigations on Electrical Conduction: The Hon. R. J. Strutt.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Bacterial Sewage-Disposal Works, at Ash, Dover: H. S. Watson.

PHYSICAL SOCIETY, at 5.—An Electrical Thermostat: H. Darwin.—Dimensional Analysis of Physical Quantities and the Correlation of Units: A. F. Ravenshear.—Note on the Dimensions of Physical Quantities: R. J. Sowter.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Address by the president, J. H. Wicksteed.—The Education of Engineers in America, Germany and Switzerland: Prof. W. E. Dalby.

MONDAY, APRIL 27.

SOCIETY OF ARTS, at 8.—Mechanical Road Carriages: W. Worby Beaumont.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Four Years' Arctic Exploration in the *Fram*: Captain Otto Sverdrup.

INSTITUTE OF ACTUARIES, at 5.—On the Valuation of Staff Pension Funds. Part II. Widows' and Children's Pensions: H. W. Manly; With Tables by H. Foot.

TUESDAY, APRIL 28.

ROYAL INSTITUTION, at 5.—The Blood and some of its Problems: Prof. Allan Macfadyen.

SOCIETY OF ARTS, at 7.30.—Visit to the Whitefriars' Glass Works.—Modern Table Glass: Harry Powell.

ANTHROPOLOGICAL INSTITUTE, at 8.15.—The Classification of the Materials of Anthropology: E. N. Fallaize.—Measurements of the Colonial Coronation Contingent: J. Gray.—Implements used by West Australian Natives in Manufacture of Glass Spear-Heads: H. Balfour.

WEDNESDAY, APRIL 29.

SOCIETY OF ARTS, at 8.—Automatic Wagon Couplings on British Railways: T. A. Brockelbank.

GEOLOGICAL SOCIETY, at 8.—The Age of the Swiss Alpine Lakes: Dr. C. S. DuRiche Preller.—On a Shelly Boulder-Clay in the so-called Palagonite-Formation of Iceland: Helgi Pjetursson.

THURSDAY, APRIL 30.

ROYAL SOCIETY, at 4.30.—Croonian Lecture: The Cosmical Function of the Green Plant: Prof. K. A. Timirjazev.

ROYAL INSTITUTION, at 5.—Hydrogen: Gaseous, Liquid and Solid: Prof. Dewar, F.R.S.

FRIDAY, MAY 1

ROYAL INSTITUTION, at 9.—Recent Advances in Stereochemistry: Prof. W. J. Pope.

CONTENTS.